

Mark Scheme (Results)

Summer 2018

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 3H

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General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

1 All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.

Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive. When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the response should be sent to review.

2 All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no answer) indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

Questions where working is not required: In general, the correct answer should be given full marks.
Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

3 Crossed out work

This should be marked **unless** the candidate has replaced it with an alternative response.

4 Choice of method

If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.

If no answer appears on the answer line, mark both methods **then award the lower number of marks.**

5 Incorrect method

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review for your Team Leader to check.

6 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, but if ambiguous do not award.
Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

7 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question or its context. (eg an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg incorrect algebraic simplification).

8 Probability

Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9 Linear equations

Unless indicated otherwise in the mark scheme, full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously identified in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded (embedded answers).

10 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and all numbers within the range.

11 Number in brackets after a calculation

Where there is a number in brackets after a calculation E.g. 2 × 6 (=12) then the mark can be awarded **either** for the correct method, implied by the calculation **or** for the correct answer to the calculation.

12 Use of inverted commas

Some numbers in the mark scheme will appear inside inverted commas E.g. "12" × 50 ; the number in inverted commas cannot be any number – it must come from a correct method or process but the candidate may make an arithmetic error in their working.

13 Word in square brackets

Where a word is used in square brackets E.g. [area] × 1.5 : the value used for [area] does **not** have to come from a correct method or process but is the value that the candidate believes is the area. If there are any constraints on the value that can be used, details will be given in the mark scheme.

14 Misread

If a candidate misreads a number from the question. Eg uses 252 instead of 255; method or process marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.

Guidance on the use of abbreviations within this mark scheme	
M	method mark awarded for a correct method or partial method
P	process mark awarded for a correct process as part of a problem solving question
A	accuracy mark (awarded after a correct method or process; if no method or process is seen then full marks for the question are implied but see individual mark schemes for more details)
C	communication mark
B	unconditional accuracy mark (no method needed)
oe	or equivalent
cao	correct answer only
ft	follow through (when appropriate as per mark scheme)
sc	special case
dep	dependent (on a previous mark)
indep	independent
awrt	answer which rounds to
isw	ignore subsequent working

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
1 (a)	negative	B1	cao	Ignore any description of a relationship and any reference to strength of correlation
(b)	Explanation	C1	for a correct explanation, eg "not in line with the trend of the other points" "does not fit in with the correlation" "is far away from the other points or line of best fit"	
(c)	Comment	C1	for an explanation eg "point would be outside of the range of the scatter diagram"	
2	$9p + 13$	M1	for method to expand one bracket, eg $5 \times p + 5 \times 3$ $(= 5p + 15)$ or $2 \times 1 - 2 \times 2p$ $(= 2 - 4p)$ or $-2 \times 1 - 2 \times -2p$ $(= -2 + 4p)$	If an attempt is made to multiply by -2 in the second brackets then it must be done consistently.
		A1	cao	
3	Triangle of area 18	M1	for a complete method to find area of trapezium eg $\frac{1}{2}(2 + 7) \times 4$ $(= 18)$ **OR** for a triangle drawn of area 36 **OR** for a triangle that would give an area ft their area of trapezium	The value for the area of the trapezium must be clear for the ft to be checked.
		A1	for a triangle drawn of area 18 eg base = 6, height = 6 or base = 9, height = 4	Accept use of dimensions that are not whole numbers as long as the intention is clear

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
4	Probabilities should sum to 1	C1	for stating that the probabilities should total 1 eg 0.25 should be 0.35	
	0.35 and 0.65 reversed	C1	for recognising that the 0.35 and 0.65 in the first branches for the 2nd throw should be reversed eg, "for the second throw, the probability it lands on 4 should be 0.65"	Can be shown on the diagram
5 (a)	50.5	M1	for $\cos ABC = \frac{7}{11}$ (0.63…) oe	Must be a complete statement for cos, sin or tan with all three elements present.
		A1	for answer in the range 50.4 to 50.51	If an answer is in the range 50.4 to 50.51 is given in the working space then incorrectly rounded, award full marks.
(b)	Increase (supported)	C1	States increase with supporting reason eg " $\frac{7}{10}$ is greater than $\frac{7}{11}$" " 0.636 is less than 0.7" …."cos increases as angle decreases" "decreasing the denominator increases the value of the fraction" "angle is now 45.6" (accept 45.5 – 45.6)	If figures are given they must be correct (truncated or rounded).

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
6 (a)	8	P1	for process to find sum of unknown probabilities, eg $1 - 0.45 - 0.25$ (= 0.3) **OR** to find the total number of counters in the bag, eg $\frac{18}{0.45}$ (= 40) **OR** to find the number of yellow counters, eg $\frac{0.25}{0.45} \times 18$ (= 10)	Award mark for any two probabilities given that sum to 0.3 eg given in the table.
		P1	for process to find P(red) = 0.2 oe **or** P(white) = 0.1 oe **OR** for process to find the total number of red and white counters, eg "40" – 18 – "10" (=12) **OR** for process to derive an equation in x, eg $2x + x = 1 - 0.45 - 0.25$ or $2x + x =$ "0.3" or $x = 0.1$	Award P2 for P(red) or P(white) (could be shown in table) Equations could be given as written statements or working but must be fully equivalent.
		P1	for a complete process to find the number of red counters, eg $\frac{2 \times 0.1}{0.45} \times 18$ or $\frac{2}{3} \times$ "12" or $0.2 \times$ "40" or $\frac{0.2}{0.025}$	
		A1	cao	
(b)	Explanation	C1	for explanation eg 0.5 multiplied by an odd number will never be a whole number, for half of a number to be an integer that number must be even, you can't have half a marble	

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
7	3.8	M1	for a correct first step, eg $5 - x = 2(2x - 7)$ or $5 - x = 4x - 14$ or $\frac{5}{2} - \frac{x}{2} = 2x - 7$	Method must show LHS ×2 and both terms on RHS ×2 or $5 - x$ and both terms on RHS ×2
		M1	(dep) for isolating terms in x eg $4x + x = 14 + 5$ or $-\frac{x}{2} - 2x = -7 - \frac{5}{2}$	eg $-4x$ both sides with -5 both sides or $+x$ both sides with $+14$ both sides
		A1	oe	Accept $\frac{19}{5}$, $3\frac{4}{5}$ oe but not $\frac{-19}{-5}$ oe

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
8	140	P1	for complete process to find sum of the interior angles of a pentagon eg $(5 - 2) \times 180$ or exterior $360 \div 5 = 72$, interior $180 - 72 = 108$, 108×5 **OR** for complete process to find sum of the exterior angles of the pentagon eg $(180 - x) + (180 - 2x) + (180 - 125) + (180 - 115) + (180 - 90)$	Must be a complete process that could lead to a figure of 540 if that process is evaluated incorrectly
		A1	for sum of interior angles is 540 **OR** for sum of exterior angles is 360	360 must be identified as the sum of the exterior angles
		P1	for start to process to find angle *ABC* eg [angles in a pentagon] – 115 – 125 – 90 (= 210) or $115 + 125 + 90 + x + 2x =$ [angles in a pentagon] **OR** $(180 - x) + (180 - 2x) + (180 - 125) + (180 - 115) + (180 - 90) = 360$	Award provided [angles in a pentagon] is greater than 400 Algebraic route needs to show both sides of the equation. LHS of equation may be simplified
		P1	for process to find angle *ABC* eg "210" ÷ 3 (= 70), "210" divided in the ratio 2 : 1 **or** for process to find angle *BCD* eg $\frac{2}{3} \times$ "210" **or** for $3x =$ "210" or $-3x =$ –"210"	Award if 70 is given for either *ABC* or *BCD* on the diagram
		A1	cao	Award marks for 140 on the diagram with working and not contradicted by the answer line. Award 0 marks for 140 without working.

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
9 (a)	4.52×10^3	M1	for $2.04.... \times 10^7$ oe eg $2.04....\times 10^{-5} \div 10^{-12}$ or $20.4... \times 10^6$ or 204(08163.27) **or** for correct value of T, 4517.(53....), not written in standard form, eg 4520	May be given correct to 3 sig figs or more
		A1	for answer in the range 4.51×10^3 to 4.52×10^3 (SC B1 for $6.32\ldots\times 10^{-1}$)	
(b)	Explanation	M1	for method to find the scale factor or decreased value in T, eg $\sqrt{\frac{1.1}{1.05^3}}$ (= 0.97.....) oe or $\sqrt{\frac{5.6\times 10^{-5}\times 1.1}{(1.4\times 10^{-4}\times 1.05)^3}}$ (= $4.40\ldots\times 10^3$) oe	Award mark for a correct method to calculate the scale factor or the percentage increases in w and d^3 or the decreased value of T
		C1	(dep M1) for explanation eg value of scale factor less than 1, so a decrease in T **OR** compares $4.40\ldots\times 10^3$ with their value of T from (a) provided answer to (a) is greater	This mark may only be awarded if supported by numerical evidence
10	10	P1	for start to a process to find the LCM of 20, 45 and 120 (= 360), eg $45 = 3 \times 3 \times 5$ or $20 = 2 \times 2 \times 5$ or $120 = 2 \times 2 \times 2 \times 3 \times 5$ or writes down at least 3 multiples of 45 and 120	Could be presented as complete prime factor trees for 45 or 120
		P1	(dep) for a process to find number of times/hour using their LCM, eg $3600 \div 360$ or $3600 \div 720$	Must use a common multiple. Working may be in minutes.
		A1	for 10 or 11	

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
11	150 000	P1 P1 A1	for process to find cost in 2007, eg 162 000 ÷ 0.9 (= 180 000) oe for process to find cost in 2003, eg [cost in 2007] ÷ 1.2 (= 150 000) oe cao	 Award 2 marks for 162 000 ÷ 1.08 oe
12 (a)	1.5	M1 A1	for method to find the gradient of the line, eg $\frac{12}{8}$ for 1.5 oe	Must see use of scales.
(b)	Explanation	C1	Explanation relating to rate of change of volume with time, eg rate at which the container fills or change in number of litres per second or number of litres added per second	Ignore any quantities given. Award the mark for an explanation involving rate.
(c)	Explanation	C1	Explanation relating to volume (amount) of liquid in the container at the start eg number of litres in the container when $t = 0$, amount of liquid in the container to start with	
13	6.50	M1 M1 A1	for method to find ratio or scale factor of lengths or volumes eg $\sqrt{3}$: 2 or 1 : 1.15(47....) or 0.86(60…) : 1 or $\sqrt{27}$: 8 oe for complete method to find ratio of volumes and use to find required volume eg 10 ÷ ("1.15...")^3 or 10 × (“0.86…”)^3 for answer in the range 6.49 to 6.53	Scale factors may just be seen as 1.15..., 0.86...etc If an answer is given within the range then incorrectly rounded to 3 sig figs, award full marks. Accept 6.5

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
14	240	M1	for start to method to find total number of matches, eg 16×15 or $16^2 - 16$ or $16 \times 15 \times 2$ (= 480) or $\frac{16 \times 15}{2}$ (= 120)	Credit complete listing strategies
		A1	cao	
15 (a)	488 to 507	M1	for method to find area of one strip using trapezia, eg $\frac{1}{2} \times 5 \times 22$ (= 55) or $\frac{1}{2} \times 5 \times (22 + 28)$ (= 125) or $\frac{1}{2} \times 5 \times (28 + 32)$ (= 150) or $\frac{1}{2} \times 5 \times (32 + 35)$ (= 167.5) **OR** for a method to find an estimate for the area using rectangles eg 5×22 or 5×28 or 5×32 or 5×35	May use area of triangle + area of rectangle for the second, third and fourth strips – lengths must be correct. May use triangle for first strip, $\frac{1}{2} \times 5 \times 22$
		M1	for complete and correct method to find the area using four strips, eg $\frac{1}{2} \times 5 \times 22 + \frac{1}{2} \times 5 \times (22 + 28) + \frac{1}{2} \times 5 \times (28 + 32)$ $+ \frac{1}{2} \times 5 \times (32 + 35)$ or $5 \times 22 + 5 \times 28 + 5 \times 32 + 5 \times 35$	May use triangle for first strip, $\frac{1}{2} \times 5 \times 22$
		A1	for answer in the range 488 to 507 (SC B1 for using area under the curve)	
(b)	Underestimate (supported)	C1	(dep M1) for underestimate since parts not included below the graph **OR** ft their method	

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
16 (a)	42	P1	for process to find an equation in a and b, eg $a \times 2^2 + b \times 2 = -2$ ($4a + 2b = -2$) or $a \times 4^2 + b \times 4 = 12$ ($16a + 4b = 12$)	
		P1	for process to find a pair of simultaneous equations and eliminate one unknown, eg $16a + 8b = -8$ and $16a + 4b = 12$ and subtraction or $16a + 4b = 12$ and $8a + 4b = -4$ and subtraction	Allow one arithmetic error in elimination, eg $16a + 8b = -8$ and $16a + 4b = 12$ leading to $4b = 20$ but no subtraction sign seen
		A1	for $a = 2$ and $b = -5$	
		A1	cao	
(b)	$n^2 - n$	M1	for correct method, eg n^2 seen as a term	
		A1	for $n^2 - n$ oe	

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
17	13.1	P1	for start of process to find the length of BD, eg $\frac{BD}{\sin 34°} = \frac{12.5}{\sin 109°}$	
		P1	for complete process to find the length of BD, eg $BD = \frac{12.5}{\sin 109°} \times \sin 34°$ (= 7.39...)	Accept 7.4 for the award of the first two P marks
		P1	for process to find the length of AD, eg $AD^2 = 11.4^2 + \text{“ } 7.39^2 \text{ ”} - 2 \times 11.4 \times \text{“7.39”} \times \cos 86°$	
		P1	for process to use correct order of operations, eg 129.96 + 54.6(5...) – 11.7(5...) (= 172.85...)	
		A1	for answer in the range 13.1 to 13.2	If an answer is given within the range and then incorrectly rounded to 3 sig figs award full marks.

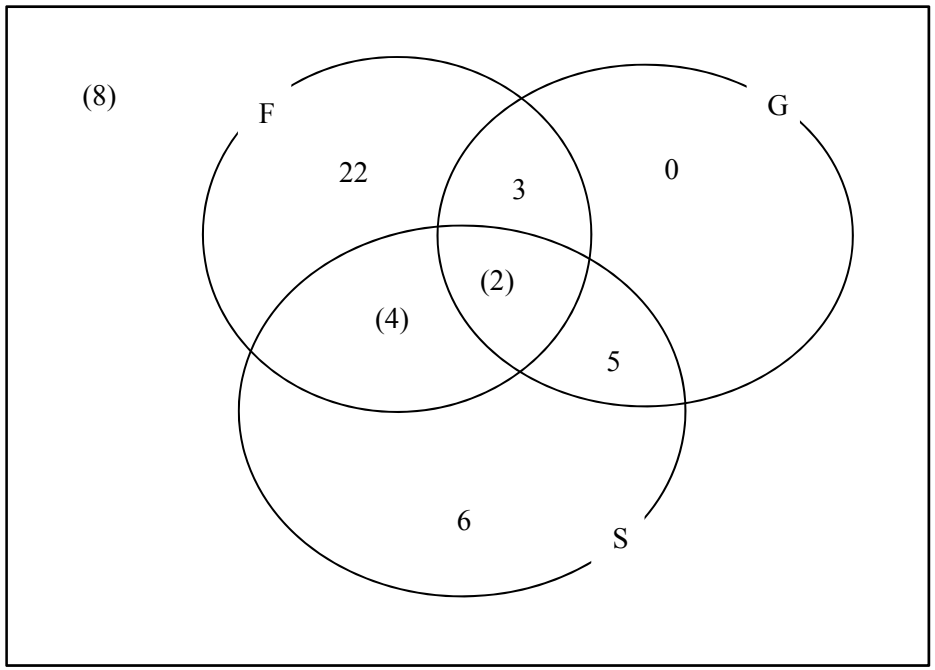
Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
18 (a)	Correct statement	C1	for substituting both 1 and 2 into $x^3 + x$ or into $x^3 + x - 7$	All arithmetic shown must be correct. Ignore any additional trials shown.
		C1	for values 2 and 10 plus explanation that these are above and below 7, or for values -5 and 3 plus explanation that there is a change of sign, thus implying a solution lies between 1 and 2	
(b)	Correct rearrangement	C1	for correct algebraic rearrangement	
(c)	1.74	M1	for substitution of 2 into the formula eg $\sqrt[3]{7-2}$ (= 1.70997…)	$x_1 = 1.70997\ldots$ $x_2 = 1.74241\ldots$ $x_3 = 1.73884\ldots$
		M1	for a substitution of x_1 to give x_2 (= 1.74241...)	Accept an accuracy of 2 dp or more rounded or truncated for values of x_1 and x_2
		A1	for answer in the range 1.738 to 1.74	Award the marks for 1.7 on the answer line provided correct iterations are shown in the working space.

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
19	$\frac{5}{3}$	P1	for process to derive an equation in x, eg $\frac{x}{4x-1}=\frac{6x+5}{12x+31}$	
		P1	for complete process to remove fractions, eg $x(12x + 31) = (6x + 5)(4x – 1)$	Must be correct use of brackets
		P1	for process to reduce to a quadratic equation, eg $12x^2 – 17x – 5 = 0$	Award for correct LHS only.
		P1	for process to solve the quadratic equation by factorisation or use of quadratic formula, eg $(4x + 1)(3x – 5) = 0$	Award for correct LHS only. Accept substitution into the formula; $\frac{--17\pm\sqrt{(-17)^2-4\times12\times-5}}{2\times12}$
		A1	for $\frac{5}{3}$ oe	Accept answers in the range 1.66 to 1.67 as equivalent

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
20	$\frac{6}{490}$	P1	for start to process information, eg draws Venn diagram and shows at least 1 unknown amount, eg 5 speak German and Spanish but not French	See Venn Diagram at end of mark scheme – rectangle not needed
		P1	for process to find at least 3 unknown amounts from, eg 5 speak German and Spanish but not French 3 speak French and German but not Spanish 22 speak French but not German or Spanish 0 speak German but not French or Spanish	
		P1	for complete process to find number of people who speak only Spanish (= 6)	Award first 3 marks to students who show this on the Venn diagram or in a statement.
		P1	for $\frac{\text{[number speaking Spanish only]}}{50} \times \frac{\text{[number speaking Spanish only]} - 1}{49}$, eg $\frac{6}{50} \times \frac{5}{49}$	Award this mark for use of their number of students who speak Spanish. Must be a clear link, eg from Venn diagram
		A1	for $\frac{6}{490}$ oe	See note 8 in general marking guidance but 0.01 or 1% must be from seen correct working.

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
21 (a)	Proof	C1	for starting the proof, identifying a pair of relevant equal sides or angles with reasons from $AD = BC$ (opposite sides of a parallelogram are equal) angle PAD = angle QCB (opposite angles of a parallelogram are equal) angle ADP = angle CBQ (given or both 90^o)	
		C1	(dep C1) for complete identification of all three equal aspects with reasons	
		C1	(dep C2) for conclusion of congruency proof	Congruency conclusion must include a reference to ASA
(b)	Explanation	C1	for identifying a pair of equal sides or angles in $APCQ$, with reason, eg $AP = QC$ since triangle ADP is congruent to triangle CBQ	
		C1	(dep C1) for reasoning that $APCQ$ is a parallelogram so opposite sides of a parallelogram are parallel	

Q20

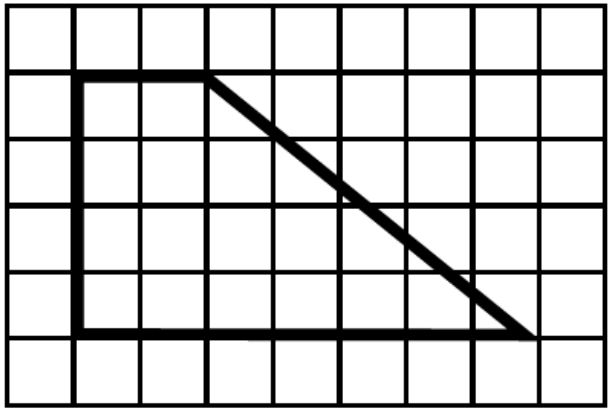


Modifications to the mark scheme for Modified Large Print (MLP) papers.

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:
Angles: ±5º
Measurements of length: ±5 mm

Paper: 1MA1/3H			
Question		**Modification**	**Mark scheme notes**
1		Diagram enlarged. Axes labels moved to the left of the horizontal axis and above the vertical axis. Crosses changed to solid dots. Right axis has been labelled.	Standard mark scheme

Paper: 1MA1/3H			
Question		**Modification**	**Mark scheme notes**
3		Shape changed but the area is still the same. Wording changed to 'Look at the diagram for Question 21 in the Diagram Book. It shows a trapezium drawn on a grid of squares. Each square on the grid represents a 1 cm square. A triangle is going to be drawn that is equal in area to the trapezium. Write down the length of the base and the vertical height of a triangle that is equal in area to the trapezium.' Two answer lines have been provided. Each square on the grid represents a 1 cm square. 	M1 for a method to find area of trapezium, eg. $\frac{1}{2}(2+7)\times 4$ (=18) or $(2\times 4)+(0.5\times 5\times 4)$ or $8+10$ (=18) or for two answers that would give a triangle of area ft their area of trapezium (if not 18) or for two answers that would give a triangle of area 36 A1 for two answers given that would give a triangle of area 18, eg. base = 6, height = 6 or base = 9, height = 4 oe NB: answers need not be whole numbers.
4		Diagram enlarged. Wording added 'It shows a probability tree diagram	Standard mark scheme

Paper: 1MA1/3H			
Question		**Modification**	**Mark scheme notes**
5		Diagram enlarged. Wording added 'AB = 11cm CB = 7cm Angle ACB is a right angle. Angle ABC is marked.'	Standard mark scheme
6		Table has been turned to vertical format. Order of the table changed round so it reads: blue, yellow, red and white.	Standard mark scheme
8		Diagram enlarged. Angles moved outside of the angle arcs, with smaller arcs. Wording added 'Angle EAB = 125^o Angle AED = 115^o Angle EDC is a right angle.'	Standard mark scheme
10		Pictures removed. Wording changed to 'There are three lamps, lamp A, lamp B and lamp C.'	Standard mark scheme
12		Diagram enlarged. Right axis has been labelled. Axes labels moved to the left of the horizontal axis and above the vertical axis.	Standard mark scheme
13		Pictures removed. Wording added 'shape A and shape B.'	Standard mark scheme
15		Diagram enlarged. Right axis has been labelled. Axes labels moved to the left of the horizontal axis and above the vertical axis.	Standard mark scheme, but apply MLP tolerances when reading figures from the graph (extra tolerance needed).
17		Diagram enlarged. Angles moved outside of the angle arcs, and the arcs have been made smaller. Wording added 'The diagram shows a shape labelled ABCD. AB = 11.4 cm, CD = 12.5 cm, Angle ABD = 86^o, Angle DBC = 109^o, Angle BCD = 34^o.'	Standard mark scheme

Paper: 1MA1/3H			
Question		**Modification**	**Mark scheme notes**
19		Diagrams enlarged. Angles moved outside of the angle arcs, and the arcs have been made smaller. Braille will label the triangles and add information about the measurements of the triangles.	Standard mark scheme
21		Diagram enlarged. Arrows made longer. Wording added 'ABP and QDC are straight lines and parallel.', 'AD is parallel to BC.'	Standard mark scheme

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